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differently constituted from themselves, as to be insensible to cold, to hunger, and to nakedness, and capable of enduring the vicissitudes of a variable climate, which they are hardly able to encounter, fortified with every comfort that ingenuity, selfishness and opulence can supply; to such, an appeal in behalf of poverty is nugatory, they would deride the vindicator of the indigent, and brand him either with treason or methodism; there are others who feel differently, and to them I would suggest the propriety of making some provision for the well-being of the poor; and none seems more obvious as well as more essential than what relates to their bedding; they should be all induced to alter the fatal habit which necessity has engendered of sleeping on the damp floor of their cabins, and furnished with sufficient covering to protect them from the inclemency of the season, nor will this essential relief fall heavily on the better classes, if they adopt a plan which has heretofore been attended with success, and in its issue reflected equal credit upon the honour and punctuality of the poor, and the truly christian and persevering character of its inestimable proposer.\* He, in conjunction with some of the more opulent inhabitants in his neighbourhood, subscribed a sum of money with which a number of blankets were purchased at the opening of the winter 1799; thus, bought in quantity, and consequently in reduced price, they were distributed amongst the poor, at their original value, upon condition of repayment at the rate of sixpence a week, and this repayment was guaranteed to the subscribers by one or two solvent individuals, who passed a security for the punctual reimbursement by instalments.† This arrangement, which imparted the most effectual relief, in the way most convenient to the labourer and least onerous upon the opulent, was attended with the most

complete success; the individuals who had so liberally come forward with the loan of their money, had no reason to repent their confidence or their generosity; they were repaid the principal with scrupulous exactness, and in lieu of a pecuniary interest, received the still gratitude of distress essentially relieved, that sentiment which leaves a permanent impression on the mind; which blesseth him that gives, and him that receives, and attaches the rich to the poor by the indissoluble bond of reciprocal esteem. At a future opportunity I shall trouble you with some further observations upon this subject, and a detail of the plan above alluded to, the receipts and disbursements, and the mode so judiciously adopted of making the security of the liberal consistent with the succour of the indigent. In the mean time, if what has been already urged should induce any to associate for a similar purpose, they will, if proper precautions be taken, secure to themselves a very solid gratification at a very trifling sacrifice of time and money, and effectuate that species of good most wanted in Ireland, a good unmixed with ostentation, which does not break down the mind by a sense of obligation, cherishing the principles of economy and foresight, and conferring lasting comfort on the family of the labourer.

BENEVOLOUS.

*For the Belfast Monthly Magazine.*

ON THE AURORA BOREALIS.

IT is a curious circumstance that, the *aurora borealis* (as far as the writer of this article has been able to discover) has not been observed, either in England or Ireland, during this winter or the preceding; whether it has appeared, as usual, in the northern parts of Scotland, or in any part of the Continent in the same parallel of latitude with us, would be worth while to inquire. This phenomenon is so well known in this country under the name of *streamers*, that it is unnecessary for us here to spend much time in describing it. It generally begins in the north extending towards the west, but sometimes inclining to-

\* The Rev. James Dunne.

† This plan has been adopted by the Maryborough Charitable Society, see *Belfast Monthly Magazine* for August 1809, page 104.

wards the east, a few hours after sun-set, or between that and mid-night, by a cloud appearing either in the horizon or elevated a few degrees above it, seldom so high as  $40^{\circ}$ , yet sometimes its elevation reaches to  $50^{\circ}$ ; or the cloud is separated from the horizon so that the blue sky may be seen between them. Its length possesses various parts of the horizon, from 5 to 120 degrees. This cloud is sometimes of a whitish colour, but oftener dark. The upper part exhibiting nearly the figure of a segment of a circle of which the horizon forms the chord. The visible part of its circumference soon becomes figured with a whitish kind of light that gives a luminous arch, or a number of concentric arches distinguished from one another by edgings composed of the obscure matter of the segment; but when the phenomenon increases so as to spread to a considerable extent, its progress shows itself by a general movement of the whole mass; numerous breaches are formed and instantly disappear in the arch and obscure segment, while vibratory corruscations of light strike as by shocks every portion of the matter constituting the phenomenon; but, as for us who only see the extremities of these northern phenomena, we can have but a faint idea of their splendour or motions. It is in the northern latitudes of Sweden and Lapland that the *aurora borealis* are so singularly beautiful in their appearance, and afford travellers by their almost constant effulgence, a very beautiful light during the long winter nights. The hunters, who pursue the white and blue foxes in the confines of the icy sea, are often overtaken in their course by these northern lights. Their dogs are often so frightened, that they will not move, but lie obstinately on the ground till the noise has passed; for in these northern latitudes they are always accompanied with a rushing noise through the air, and sometimes slight detonations are distinctly heard. Similar lights, called *aurora australes* have been frequently observed towards the south pole, (see Phil. Trans. no. 461, sect. 23, 24 and 25, and vol. liv. no. 53).

This phenomenon was certainly known to the ancients, and is described by Aristotle in his meteorology, lib. 1, c. 4, 5, as well as by many others of the ancient philosophers; but they were not so frequent in the more cultivated parts of Europe till about the year 1716, when by their more frequent appearance, they then began to attract the attention of almost all the eminent philosophers of Europe; and accordingly, since that time, various theories have been formed to account for their origin and appearance; however even at this day it is still a matter of doubt. The aurora, was by the ancients attributed to vapours and exhalations, which, arising from the earth mix together, afterwards ferment, and at length take fire; others again imagine that the ice and snow of the polar circle reflect the solar rays towards the concave surface of the upper regions of the atmosphere whence they were sent back to us and produced these appearances that accompany the aurora borealis. (See Halley's *Traité de physique*.) Amongst the modern philosophers who studied this part of meteorology with great attention is Mairan, who in his *Traité de l'Aurore Boreale*, supposes that the phenomenon takes place, when the solar atmosphere approaches so near the earth as to be more exposed to the attraction of this planet than to the sun's attraction, when once within the sphere of activity of the earth, it falls into our atmosphere and by a more rapid circular motion of the particles of the air in the equatorial regions is soon repelled towards the poles where the velocity of rotation is less, and this he states as the reason why the aurora borealis appears oftenest in the north, and then proceeds to explain the other circumstances of the phenomenon, and also of the zodiacal light. As the aurora borealis, which Mairan supposes to have its station in the atmosphere, is sometimes elevated more than 760 miles above the surface of the earth, this philosopher was obliged to give the atmosphere a height incomparably greater than is generally ascribed it; besides according to this hypothesis the aurora should proceed from the equator to the poles in-

stead of proceeding from the poles towards the equator as it invariably does. These defects in Mairan's theory was observed by the celebrated Euler, who proposed a new theory, which Mairan in his turn attempted to refute. This opinion supposes the particles of our atmosphere to be driven by the impulse of the solar rays to a great distance, and to become luminous by those rays being reflected on their surface. Euler extends this explanation to the appearance of the tails of comets and the zodiacal light; but it is unnecessary to follow him, as he has not supported his theory by any decisive argument. Among the causes to which the *aurora borealis* has been ascribed, it was impossible electricity could be forgotten, and the development of this theory belongs of right to Franklin; according to this celebrated philosopher, the electric fluid conveyed from the equator to the polar regions by clouds that are charged with it, falls with the snow on the ice that covers those regions; and being accumulated there, breaks through that low atmosphere, and runs along in the vacuum over the air towards the equator, diverging as the degrees of longitude enlarge, till it finds a passage to the earth in more temperate climates, or is mingled with the upper air, and gives all the appearances we have mentioned (see Hall's *Nat. Phil. Trans.* by Gregory).

The ingenious Mr. Dalton, in his *Meteorological Observations and Essays*, supposes the *aurora borealis* to be a magnetic phenomenon, whose beams are governed by the earth's magnetism, as it is highly probable that magnetism is nothing but electricity, or a modification of the electric fluid, Mr. Dalton's theory differs but little from Franklin's. The ingenious M. Libes has lately proposed a new theory of the *aurora borealis*, which has already been adopted by most of the northern philosophers. This is the most satisfactory theory that has yet appeared, and is an improvement of Dr. Franklin's, as the reader will easily perceive. According to this philosopher, as stated in the words of the respectable and ingenious Olinthus Gregory, the production of hydrogen

gas is next to nothing at the poles; therefore as often as the electricity is put into an equilibrated state in the atmosphere, the spark, instead of passing through a mixture of hydrogenous and oxygenous gas, as in our climates, passes through a mixture of oxygenous and azotic gas, it must therefore cause a production of nitrous gas, nitrous acid and nitric acid, which give birth to ruddy vapours, whose red colour will vary according to the quantity and proportion of those different substances which are generated; these vapours are carried towards the meridian, where the air is most dilated, so that they approach more and more towards the spectator, and it is probable that their motion may be assisted by a north wind.

Lastly, the slight detonations which are sometimes heard, depend upon the small quantity of hydrogenous gas, which is found in the upper regions of the atmosphere, and which combines with the oxygen to form water. These principles at the same time that they account, in M. Libes' estimation, for all the phenomena accompanying the *aurora borealis*, explain also, why it is so common towards the poles, and so rare in temperate regions; while thunder, which is frequent in the torrid zone, is scarcely ever heard in the polar regions.

The disengagement of hydrogenous gas is considerable near the equator, and very little towards the poles; and when we excite the electric spark in a mixture of hydrogen, oxygen, and azote; it combines in preference, the bases of the two former gases; the electric spark ought therefore, to occasion thunder solely in hot countries, and to produce *aurora borealis* alone in cold countries. This is in fact found to be the case; the torrid zone, is the ordinary theatre of thunder-storms; at 40 or 50 degrees they rarely occur out of the summer season; and near the poles they scarcely occur at all. The rain of the storm is accompanied by lightning; and preceded by a period of heat which greatly facilitates the decomposition of water: there must therefore be a great quantity of disengaged hydrogen, which is raised into the superior parts of the atmosphere;

and this hydrogen, when passing into the gaseous state, carries with it a great quantity of electricity. Now it cannot be doubted that lightning is produced by the electric fluid.— But as to the rain that is formed, the moment when the lightning traverses the air, it can only arise from two causes; either from the sudden precipitation of the water which was dispersed in the atmosphere; or from a combination of the oxygen and hydrogen gas, occasioned by the electric spark. Libes remarks that the rain of a storm takes place very frequently without there having been previously any cloud to disturb the transparency of the atmosphere; yet it cannot be supposed that the water, which is in very small quantities and perfectly dissolved in the air, can be so precipitated at once, as to form an abundant rain. Hence he recurs on the contrary to the electric spark, which in its passage, effected with an inconceivable rapidity, meets with mixtures of oxygen and hydrogen gas, the combination of whose bases becomes effected and give birth to violent explosions, as well as to a quantity of rain proportional to the quantity of æriform fluids that have served to produce the shower. This hypothesis explains clearly how there may be lightning without thunder, though there may be many clouds in the air; and why there should be many thunder-storms in hot countries, while there are but few in cold ones.

March 24, 1810.

G.

*For the Belfast Monthly Magazine.*

*Wishing to introduce to our Readers the improved system of managing jails, evinced by practical experiment, and as the moral discipline of a prison is essentially connected with a plan to mitigate the severity of the penal code, which plan we sincerely rejoice to find is in agitation, we are induced to give extracts from a pamphlet published some years ago entitled,*

A VISIT TO THE PHILADELPHIA PRISON, IN A LETTER TO A FRIEND, BY ROBERT J. TURNBULL, OF SOUTH CAROLINA.

**E**XTERNALLY this prison presents itself as a very strong and

secure building, constructed of stone, with a ground floor and two stories; and rather resembling an incomplete hollow parallelogram than any other form, with a north front on Walnut, and a south one on Prune street.— The principal front on Walnut-street, measures 190 feet in length, and 40 feet in depth. The east and west sides or wings of the same depth, respectively, extend at right angles with the main front, 95 feet in a southern-direction, and then join stone walls of 20 feet in height, running to the south-east, and south-west corners. The west wing is on South Sixth street. These three sides are appropriated for the confinement of criminals, vagrants, &c. and whose outward appearance does not much resemble a prison, but is neat, handsome, and no inconsiderable ornament to the city.

Nearly contiguous to the east wing, is a brick edifice of two stories, raised upon arches, of about 40 feet in length, and 25 in breadth, set apart for the purpose of solitary confinement. The south front on Prune-street, is partly the wall, and partly the debtor's apartment, a stone building originally intended for a work-house, about 45 feet in length, and 55 in depth. The whole of the buildings, stand on a lot of 200 feet by 400; 100 feet of the south part of which is divided off for the use of the debtors, by a wall running east and west.

Having been previously prepared with a permit, procured by a friend from one of the committee of Inspectors, to visit the prison, we delivered it at the door, when orders were immediately given to a turnkey, to conduct us through the different parts of it. We were first shown through the grand entry, secured by an iron grated door about midway, and from thence (across a court or passage running from one end of the front to the other) directly into the yard of the prison. Conceive my friend, the pleasant sensations which by turns took possession of our minds at the time, when I declare, that instead of having our eyes pulled as we might naturally expect, by the gloomy appearance of